

Fresh Market/Slaw and Kraut Cabbage Germplasm Evaluation Results in 2001

Information on the Effects of
Planting Date and Genotype on
Fresh Market/Slaw and Kraut Cabbage
Yield and Head Traits in Ohio in 2001

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Seminis
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Tokita
Vilmorin**

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The Grower's Section

A complete description of this study and our findings begins on page 3. The "Grower's Section" is offered for quick reference.

What Did We Do?

We planted twenty-seven varieties and experimental lines of fresh market/slaw-type cabbage at the Vegetable Crops Research Branch in Fremont, OH on May 10 and June 20, 2001. We also planted fourteen varieties and experimental lines of kraut-type cabbage on the same dates and at the same location but in a separate study. Replicated field plots were used (this was not an un-replicated strip trial). Plots and heads were examined regularly throughout the season and at harvest. Post-harvest evaluations of quality were also completed in the lab.

Why Did We Do this Project?

This project was undertaken to assist the Ohio cabbage industry in identifying varieties with desirable traits. Head traits (e.g., size, weight, density, freedom from physiological disorders, core size, etc.), marketable yield, and resistance to biological and environmental stresses and other variety traits influence the return from cabbage production. To be successful, the Ohio cabbage industry must have available varieties adapted to the state's production and market conditions. Because cabbage varieties often differ in traits which impact profit, scientifically measuring and documenting the performance of varieties under varied, local conditions is important. Reliable information from an unbiased testing program is useful in variety selection.

What did We Find?

Fresh Market/Slaw Study

1. Yield. See Table 5 for more information. In the spring, total and marketable yield averaged 29.7 and 29.0 ton/A, respectively. But, in the summer, total and marketable yield averaged 32.4 and 28.6 ton/A, respectively. CXB 93256 selection had the greatest marketable yield in the spring planting while Cheers had the greatest marketable yield in the summer planting. The marketable yield of twenty-three of twenty-seven entries listed in Table 8 was statistically similar following planting in May and June.

2. Head and Core Traits. See Tables 6 and 7 for more information. Head weight and size tended to be greater in the June versus May planting. However, the percent of the head's volume taken up by the core tended to be slightly greater in the spring versus summer planting. Head density tended to be greater following May versus June planting. Among all genotypes, head size was more frequently impacted by planting date than head weight and density (Table 8).

Kraut Study

1. Yield. See Table 11 for more information. In the spring, total and marketable yield averaged 34.8 and 31.9 ton/A, respectively. Total and marketable yield averaged 36.1 and 33.2 ton/A, respectively, in the summer. Score variety had the greatest marketable yield in the spring planting while Oriental Super Cross

had the greatest marketable yield in the summer planting. The marketable yield of nine of fourteen entries listed in Table 14 was similar following planting in May and July.

2. Head and Core Traits. See Tables 12 and 13 for more information. Head weight, density and size were mostly unaffected by planting date. However, the average percent of the head volume found in the core was greater in the summer planting. Head weight of nine of fourteen entries and head density of eleven of fourteen entries was similar following planting in May and July (Table 14).

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Project Details

Materials and Methods

See Table 1 for a list of the genotypes examined in the fresh market/slaw and kraut studies. See Table 2 for a summary of seasonal temperature and rainfall for the experimental site.

Transplant Production. Entries were solicited from cooperating seed companies in winter 2000-2001. Transplants were seeded in spring, allowed to develop 2-4 true leaves in the greenhouse, and hardened-off before planting into the field.

Plot Establishment. A randomized complete block design was used in each study. Each study contained four replications per entry per planting and two planting dates (May 10 and June 20). The fresh market/slaw study included twenty-seven genotypes and the kraut study included fourteen genotypes. Two-row plots were established with a cone-type two-row transplanter. Each row was 15 ft. long with 30 in. between rows and 11 in. (fresh market/slaw) and 18 in. (kraut) between transplants. A 0-46-0 fertilizer was used to supply 64 lb. P_2O_5 and a 0-0-60 fertilizer was used to supply 276 lb. K_2O on October 23, 2000. A 45-0-0 fertilizer was broadcast to supply 70 lb N/A on May 1, 2001 and later incorporated before planting. A nutrient starter solution (0.7 qt. 10-34-0/50 gal. water) was delivered next to the transplants.

Plot Maintenance. Dead transplants were replaced (if possible) within one week of initial planting. Standard pest management strategies based on scouting, thresholds, and application of labeled pesticides were employed. Overhead irrigation (1 in.) was applied to both studies on June 28 and July 16, 2001.

Data Collection (Field). Plots were reviewed twice per week to assess development. Notes on plant stature, head shape, and other traits were taken on mature entries immediately prior to harvest.

Data Collection (at Harvest). Harvest readiness for individual entries was estimated from published maturity information and visual examination of the five plots per entry. At maturity, all heads were collected from within the center 10 ft. of both rows in each plot. Heads were scored as marketable or unmarketable (too small, split, rotten, or containing evidence of blackrot or tipburn) and weighed as a group. Ten marketable heads were then selected at random from the harvested group for further evaluation. Five outer leaves were removed from each head before they were re-weighed individually. Heads were then cut in half longitudinally and the core length and base width as well as the head polar and equatorial diameter of each head recorded.

Additional Quality Analysis. Two additional marketable heads from each plot were collected at harvest and sent to the OARDC for further evaluation (fresh market/slaw study only; these data will be presented in a separate report). In addition, tissue from three marketable heads from each plot were prepared for glucosinolate analysis (fresh market/slaw study only). Glucosinolates are among the compounds known to contribute to cabbage flavor. Consumption of food products containing relatively high levels of glucosinolates, such as cabbage, is thought to have specific health benefits.

Statistical Analysis. Head density was estimated through calculation using replicate averages of head weight and polar diameter. Likewise, the percent of the head volume contained in the core was estimated through calculation using replicate averages of head polar diameter and core length and base width. Replicate averages were calculated and used in means analysis. Main effects and interactions of planting date, entry, and replicate were analyzed with fully specified model statements in SAS (alpha = 0.05). The Fisher Least Significant Difference test (alpha = 0.05) was used to analyze the effect of planting date and replicate while the Duncan Multiple Range test (alpha = 0.05) was used to analyze the effect of genotype.

Results

Both Studies

The planting date-x-entry interaction was significant (alpha = 0.01) for the majority of yield and head and core traits (Tables 3, 9). As in past studies, core volume tended to be approximately 1% of head volume (Tables 4, 10). Head weight and density were mostly unrelated as entries with the highest average head density did not consistently have the highest average head weight (Tables 6, 7, 12, 13).

Fresh Market/Slaw Study

Data are contained in Tables 3-8. Planting on May 10 versus June 20 tended to result in smaller, lighter, denser heads with larger cores but it did not affect marketable yield (Table 4). Marketable yield in the May planting ranged from 19.7 ton/A to 37.1 ton/A (Table 5). Marketable yield in the June planting ranged from 1.2 ton/A to 40.3 ton/A (Table 5). Average head weight ranged from 1232.5 g (2.7 lb) to 2460.0 g (5.4 lb.) in the May planting (Table 6) and from 1227.5 g (2.7 lb) to 2555.0 g (5.6 lb) in the June planting (Table 7). Average head density ranged from 0.699 g/cm³ to 0.908 g/cm³ in the May planting (Table 6) and from 0.549 g/cm³ to 1.159 g/cm³ in the June planting (Table 7). Red T 690 selection had the greatest average head density in the May and June plantings and the greatest average head weight in the June planting (Tables 6, 7). Marketable yield of twenty-three of twenty-seven entries listed in Table 8 was statistically similar following planting in May and June. And, among all genotypes, head size was more frequently impacted by planting date than head weight and density (Table 8). In five entries, only one of the nine traits studied were impacted by planting date (Table 8) while in four entries 4-5 of nine traits were effected by planting date (Table 8).

Kraut Study

Data are contained in Tables 9-14. Unexpectedly, planting date tended to have little effect on yield and head and core traits (Table 10). An exception to this trend was average core volume which was greater in the June than the May planting. Marketable yield in the May planting ranged from 24.1 ton/A to 42.3 ton/A (Table 11). Marketable yield in the June planting ranged from 13.0 ton/A to 46.5 ton/A (Table 11). Average head weight ranged from 2338.0 g (5.2 lb) to 3317.5 g (7.3 lb.) in the May planting (Table 12) and from 2042.5 g (4.5 lb) to 3447.5 g (7.6 lb) in the June planting (Table 13). Average head density ranged from 0.760 g/cm³ to 1.275 g/cm³ in the May planting (Table 12) and from 0.783 g/cm³ to 1.378 g/cm³ in the June planting (Table 13). Marketable yield for nine of fourteen entries was similar after planting in May versus

July and head density was similarly unaffected by planting date in eleven entries (Table 14). In all entries, at least one of nine traits studied was effected by planting date (Table 14). In four entries, at least five of nine traits were effected by planting date (Table 14).

Table 1. Number of days to harvest (DTH) for twenty-seven genotypes of fresh market/slaw- and kraut-type cabbage planted on May 10 and June 20, 2001 at the OSU Vegetable Crops Research Branch in Fremont, OH.

	----- Entry -----			May 10	June 20
Study	Name	#	Company	DTH	DTH
Fresh Market/Slaw					
	Blue Jays	1	Tokita	69	75
	Bravo	2	Harris Moran	78	79
	Bronco	3	Bejo	81	85
	Cheers	4	American Takii	81	79
	CXB 93256	5	Reed's	88	83
	Ducatt	6	Bejo	76	83
	EX5210399 (CA825)	7	Stokes via Asgrow	81	79
	Gospel	8	Siegers/SeedWorks	76	62
	Green Crown	9	Tokita	88	79
	Grenadier	10	Siegers	69	62
	HMX 0220	11	Harris Moran	88	76
	HMX 0228	12	Harris Moran	81	79
	Huron	13	Siegers	124	121
	Matsumo	14	Bejo	76	79
	Midorimaru	15	Tokita	76	76
	Platinum Dynasty	16	Stokes via Asgrow	76	76
	Polaris	17	Sakata	88	83
	Pruktor	18	Siegers/SeedWorks	76	76
	Puma	19	Alf Christianson	76	--
	Red T 690	20	American Takii	76	76
	Solid Blue #780	21	Abbott & Cobb	78	106
	Solid Blue #790	22	Abbott & Cobb	88	85
	SuperElite	23	Reed's	88	106
	XP 5210387 (CA964)	24	Stokes via Asgrow	78	85
	Red Dynasty	25	Seminis	88	106
	Silver Dynasty	26	Seminis	81	106
	Blue Dynasty	27	Seminis	78	85
Kraut					
	Almanac	1	Bejo	78	92
	GZG 239	2	Rijk Zwaan	113	113
	Hinova YR	3	Bejo	126	113
	HMX 0221	4	Harris Moran	120	113
	HMX 0222	5	Harris Moran	103	113
	HMX 0224	6	Harris Moran	147	113
	Mentor YR	7	Bejo	113	113
	Moreton Hybrid	8	Reed's	103	113
	Oriental Super Cross	9	Tokita	96	92
	Score	10	Bejo	103	113
	Strukton	11	Vilmorin	147	121
	Transam YR	12	Bejo	147	121
	Missouri	13	Seminis	147	121
	Huron	14	Seminis	147	121

Table 2. Climatic data for fresh market and processing cabbage studies planted at the OSU Vegetable Crops Research Branch in Fremont, OH in 2001.

		-- Avg. Temp (F) --		----- Precipitation (in.) -----		
		High	Low	Actual	Normal	-/+ Normal
<u>Fresh Market and Processing Studies</u>						
Planting 1 (May 10)						
May 10 - June 4 (25 d)	70.0	48.0	3.90	3.5	0.40	
June 5 - July 25 (50 d)	84.0	60.0	3.39	6.5	-3.11	
July 26 - Aug. 20 (25 d)	84.0	59.0	3.50	3.0	0.50	
Total			10.79	13.0	-2.21	
Planting 2 (June 20)						
June 20 - July 14 (25 d)	82.0	58.0	0.80	3.3	-2.50	
July 15 - Sept. 2 (50 d)	82.0	58.0	5.95	5.5	0.45	
Sept. 3 - Sept. 28 (25 d)	74.0	49.0	3.70	2.7	1.00	
Total			10.45	11.5	-1.05	

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FRESH MARKET/ SLAW-TYPE STUDY

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Table 3. Analysis of variance results for an experiment studying the impact of planting date and genotype on fresh market/slaw-type cabbage yield and head traits in Ohio in 2001.

Source	-----Yield (ton/A) -----		----- Head -----					Core -----	
	total	marketable	weight (g)	density (g/cm ³)	----- diameter -----		length (cm)	base width (cm)	percent of head volume
					polar (cm)	equatorial (cm)			
----- Pr > F -----									
Planting Date (PD)	< 0.0001	0.4447	< 0.0001	0.0110	< 0.0001	< 0.0001	< 0.0001	< 0.0001	< 0.0001
Genotype (G)	< 0.0001	< 0.0001	< 0.0001	< 0.0001	< 0.0001	< 0.0001	< 0.0001	< 0.0001	< 0.0001
PD x G	0.0009	< 0.0001	0.0004	0.1123	< 0.0001	< 0.0001	< 0.0001	0.0098	< 0.0001

Table 4. Influence of planting date on yield and head traits for twenty-seven genotypes of fresh market/slaw-type cabbage planted on May 10 and June 20, 2001 in Ohio.

Planting Date	-----Yield (ton/A) -----		----- Head -----					Core -----	
			weight (g)	density (g/cm ³)	----- diameter -----		length (cm)	base width (cm)	percent of head volume
	total	marketable			polar (cm)	equatorial (cm)			
5/10/01 (N=108)	29.7 b	29.0 a	1742 b	0.80 a	15.8 b	16.1 b	7.0 b	3.17 a	0.89 a
6/20/01 (N=107)	32.4 a	28.6 a	2067 a	0.77 b	16.4 a	18.1 a	8.1 a	2.98 b	0.72 b
LSD _(0.05)	1.29	1.44	85.4	0.03	0.2	0.26	0.19	0.04	0.03

Table 5. Average yield of twenty-seven genotypes of fresh market/slaw-type cabbage planted on May 10 and June 20, 2001 at the OSU Vegetable Crops Research Branch in Fremont, OH.

		Planting Date			
		5/10/2001		6/20/2001	
Entry		Yield (ton/A)			
Name	#	total	marketable	total	marketable
Blue Jays	1	20.3	19.7	18.6	17.0
Bravo	2	28.7	27.7	34.3	32.9
Bronco	3	36.5	35.7	35.1	33.0
Cheers	4	33.8	32.9	42.6	40.3
CXB 93256	5	38.4	37.1	39.0	37.8
Ducatt	6	31.9	31.8	37.7	32.4
EX5210399 (CA825)	7	32.1	28.2	30.9	24.5
Gospel	8	24.9	23.8	20.0	15.4
Green Crown	9	36.1	35.9	30.6	27.4
Grenadier	10	25.7	23.9	28.0	24.7
HMX 0220	11	26.3	25.4	23.8	20.8
HMX 0228	12	34.3	33.3	37.9	36.0
Huron	13	36.3	34.3	31.2	24.8
Matsumo	14	32.4	31.6	39.5	38.3
Midorimaru	15	21.4	19.3	26.5	19.5
Platinum Dynasty	16	30.4	29.2	33.4	32.7
Polaris	17	34.2	32.4	31.2	28.5
Pruktor	18	28.6	27.8	37.7	37.3
Puma	19	21.8	20.6	24.6	1.2
Red T 690	20	23.1	21.4	28.8	26.4
Solid Blue #780	21	20.3	19.0	35.8	34.1
Solid Blue #790	22	34.5	32.7	37.3	36.2
SuperElite	23	32.7	31.6	39.2	36.7
XP 5210387 (CA964)	24	37.2	36.1	36.5	34.8
Red Dynasty	25	24.6	24.1	31.0	30.1
Silver Dynasty	26	29.1	28.6	35.2	33.7
Blue Dynasty	27	26.4	25.0	32.6	30.5
CV		17.30	18.60	13.60	18.50
Pr > F		***	***	***	***
DMRT (0.05)		9.05	9.36	7.73	9.50

*** denotes significance at alpha = 0.01.

Table 6. Head and core traits for twenty-seven genotypes of fresh market/slaw-type cabbage planted on May 10, 2001 at the OSU Vegetable Crops Research Branch in Fremont, OH.

Entry		Head					Core		
Name	#	weight (g)	density (g/cm ³)	polar (cm)	equatorial (cm)	height/ width ratio	length (cm)	base width (cm)	percent of head volume
Blue Jays	1	1232.5	0.727	14.9	14.6	1.02	6.4	3.2	1.03
Bravo	2	1835.0	0.827	15.5	16.8	0.92	7.5	3.0	0.81
Bronco	3	1840.0	0.836	15.9	16.3	0.98	7.5	3.7	1.23
Cheers	4	1765.0	0.749	16.6	16.4	1.01	7.1	3.1	0.77
CXB 93256	5	2102.5	0.803	16.1	18.0	0.90	7.2	2.9	0.60
Ducatt	6	1690.0	0.811	14.5	17.1	0.85	6.8	2.9	0.76
EX5210399 (CA825)	7	2260.0	0.742	18.4	17.4	1.07	6.2	2.8	0.42
Gospel	8	1647.5	0.777	16.2	15.6	1.04	7.4	3.2	0.95
Green Crown	9	1882.5	0.789	16.1	17.1	0.94	6.5	3.3	0.79
Grenadier	10	1550.0	0.699	17.1	15.2	1.13	8.9	2.9	0.87
HMX 0220	11	1487.5	0.731	13.9	17.5	0.80	7.3	2.9	0.79
HMX 0228	12	2087.5	0.862	16.1	17.3	0.93	7.9	2.8	0.67
Huron	13	2460.0	0.847	17.9	17.5	1.03	8.3	3.8	1.11
Matsumo	14	1945.0	0.867	14.3	18.1	0.80	5.7	3.1	0.67
Midorimaru	15	1640.0	0.750	16.1	15.9	1.01	5.9	3.2	0.74
Platinum Dynasty	16	1825.0	0.790	16.4	16.3	1.01	7.0	3.7	1.07
Polaris	17	1970.0	0.781	17.4	16.2	1.07	7.5	3.4	0.92
Pruktor	18	1657.5	0.782	16.5	15.2	1.09	6.0	3.3	0.85
Puma	19	1320.0	0.821	15.3	13.6	1.12	5.3	3.9	1.32
Red T 690	20	1502.5	0.908	14.2	15.1	0.94	6.5	3.0	0.95
Solid Blue #780	21	1107.5	0.821	13.8	13.5	1.02	7.1	3.2	1.38
Solid Blue #790	22	1840.0	0.825	15.0	17.4	0.86	8.0	3.0	0.87
SuperElite	23	1927.5	0.857	15.7	16.8	0.94	8.0	3.2	0.95
XP 5210387 (CA964)	24	1897.5	0.837	16.4	16.2	1.01	6.6	2.9	0.66
Red Dynasty	25	1400.0	0.797	16.2	13.9	1.17	7.3	3.2	1.08
Silver Dynasty	26	1570.0	0.836	15.1	15.5	0.98	6.2	2.9	0.75
Blue Dynasty	27	1582.5	0.824	15.2	15.4	0.99	6.8	3.1	0.96
CV		16.11	4.8871	5.64	6.20	3.380	8.58	4.94	14.163
Pr > F		***	***	***	***	***	***	***	***
DMRT _(0.05)		492.50	0.0689	1.57	1.76	0.059	1.05	0.28	0.221

*** denotes significance at alpha = 0.01.

Table 7. Head and core traits of twenty-seven genotypes of fresh market/slaw-type cabbage planted on June 20, 2001 at the OSU Vegetable Crops Research Branch in Fremont, OH.

Entry		Head					Core		
Name	#	weight (g)	density (g/cm ³)	polar (cm)	equatorial (cm)	height/ width ratio	length (cm)	base width (cm)	percent of head volume
Blue Jays	1	1227.5	0.576	15.0	16.8	0.89	7.2	2.8	0.70
Bravo	2	2340.0	0.799	15.8	19.6	0.81	8.6	3.0	0.71
Bronco	3	2013.0	0.765	17.6	16.6	1.11	9.4	3.5	1.13
Cheers	4	2325.0	0.725	16.9	19.6	0.87	9.1	3.0	0.67
CXB 93256	5	1957.5	0.673	16.6	18.8	0.88	8.7	2.7	0.57
Ducatt	6	2335.0	0.814	15.8	20.0	0.81	8.1	2.7	0.57
EX5210399 (CA825)	7	1887.5	0.736	16.4	17.5	0.94	7.0	2.7	0.53
Gospel	8	1370.0	0.781	14.1	15.8	0.90	7.2	2.8	0.85
Green Crown	9	1980.0	0.807	14.1	19.4	0.73	7.0	3.2	0.77
Grenadier	10	1870.0	0.658	17.5	17.7	1.00	9.0	2.8	0.66
HMX 0220	11	1402.5	0.549	15.4	18.6	0.83	7.5	2.6	0.51
HMX 0228	12	2485.0	0.708	17.8	19.8	0.90	9.6	2.8	0.59
Huron	13	2432.5	0.922	17.3	16.9	1.10	8.7	3.9	1.30
Matsumo	14	2462.5	0.852	15.4	20.0	0.78	7.2	3.2	0.68
Midorimaru	15	2202.5	0.666	17.9	19.1	0.94	6.1	3.1	0.48
Platinum Dynasty	16	2187.5	0.752	16.6	18.8	0.89	7.7	3.1	0.66
Polaris	17	1952.5	0.792	16.8	16.8	1.00	9.1	3.3	1.04
Pruktor	18	2300.0	0.750	17.1	18.9	0.91	8.2	3.2	0.71
Puma	19	--	--	--	--	--	--	--	--
Red T 690	20	2555.0	1.159	15.2	16.8	0.91	7.3	2.6	0.61
Solid Blue #780	21	2025.0	0.819	16.3	17.2	0.95	8.7	3.1	0.87
Solid Blue #790	22	2119.5	0.687	17.1	19.0	0.90	10.6	2.9	0.74
SuperElite	23	2297.5	0.812	16.5	18.6	0.90	8.1	3.1	0.74
XP 5210387 (CA964)	24	2131.5	0.751	17.3	17.8	0.98	7.5	2.8	0.53
Red Dynasty	25	1715.0	0.769	17.3	15.0	0.12	7.5	3.1	0.87
Silver Dynasty	26	2180.0	0.832	17.1	17.0	1.00	6.0	2.8	0.47
Blue Dynasty	27	1993.0	0.781	16.5	17.4	0.95	9.1	3.0	0.82
CV		18.13	18.2353	4.32	5.74	4.698	9.90	5.12	15.004
Pr > F		***	***	***	***	***	***	***	***
DMRT _(0.05)		656.80	0.2451	1.24	1.82	0.076	1.40	0.27	0.190

*** denotes significance at alpha = 0.01.

Table 8. Influence of planting date on yield and head traits of twenty-seven genotypes of fresh market/slaw-type cabbage planted on May 10 and June 20, 2001 at the OSU Vegetable Crops Research Branch in Fremont, OH. An asterisk (*) indicates that planting date had a significant effect on the variables listed within within the genotype according to the Fisher Least Significant Difference test (alpha = 0.05). Analysis based on the mean of four replicates per planting.

Entry		yield (ton/A)		head				core			# of 9 traits effected by planting date
Name	#	total	marketable	weight (kg)	density (g/cm ³)	diameter (cm.) polar	diameter (cm.) equatorial	length (cm.)	base width (cm.)	% of head volume	
Blue Jays	1				*		*	*	*	*	5
Bravo	2			*			*	*			3
Bronco	3				*	*		*	*		4
Cheers	4	*		*			*	*		*	5
CXB 93256	5				*			*	*		3
Ducatt	6			*		*	*	*			4
EX5210399 (CA825)	7					*					1
Gospel	8		*			*			*		3
Green Crown	9					*	*	*	*		4
Grenadier	10			*			*			*	3
HMX 0220	11				*	*			*	*	4
HMX 0228	12				*	*	*	*			4
Huron	13				*						1
Matsumo	14			*		*					2
Midorimaru	15			*	*	*	*			*	5
Platinum Dynasty	16						*		*	*	3
Polaris	17							*			1
Pruktor	18						*	*			2
Puma	19		*								1
Red T 690	20	*					*		*	*	4
Solid Blue #780	21	*	*	*		*	*			*	6
Solid Blue #790	22				*	*		*			3
SuperElite	23									*	1
XP 5210387 (CA964)	24				*	*	*			*	4
Red Dynasty	25	*	*							*	3
Silver Dynasty	26			*		*	*			*	4
Blue Dynasty	27							*	*		2
number comparisons of 27 significant		4	4	8	9	13	14	12	9	12	

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KRAUT-TYPE STUDY

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Table 9. Analysis of variance results for an experiment studying the impact of planting date and genotype on kraut-type cabbage yield and head traits in Ohio in 2001.

Source	Yield (ton/A)		Head				Core		Pr > F
	total	marketable	weight (g)	density (g/cm ³)	diameter		length (cm)	base width (cm)	
					polar (cm)	equatorial (cm)			
Planting Date (PD)	0.2132	0.2289	0.1282	0.5356	0.5585	0.0275	< 0.0001	0.0008	0.0109
Genotype (G)	< 0.0001	< 0.0001	0.0007	0.0840	< 0.0001	< 0.0001	< 0.0001	< 0.0001	< 0.0001
PD x G	0.0039	< 0.0001	0.0044	0.4147	< 0.0001	0.0013	0.0002	< 0.0001	< 0.0001

Table 10. Influence of planting date on yield and head traits for fourteen genotypes of kraut-type cabbage planted on May 10 and June 20, 2001 in Ohio.

Planting Date	Yield (ton/A)		Head				Core		
	total	marketable	weight (g)	density (g/cm ³)	diameter		length (cm)	base width (cm)	percent of head volume
					polar (cm)	equatorial (cm)			
5/10/01 (N=56)	34.8 a	31.9 a	2593 a	0.91 a	17.1 a	18.1 b	6.81 b	3.57 a	0.80 b
6/20/01 (N=56)	36.1 a	33.2 a	2719 a	0.93 a	17.2 a	18.5 a	7.55 a	3.47 b	0.88 a
LSD (0.05)	2.05	2.27	163.1	0.08	0.23	0.36	0.23	0.06	0.06

Table 11. Average yield of fourteen genotypes of kraut-type cabbage planted on May 10 and June 20, 2001 at the OSU Vegetable Crops Research Branch in Fremont, OH.

		Planting Date			
		5/10/2001		6/20/2001	
Entry		Yield (ton/A)			
Name	#	total	marketable	total	marketable
Almanac	1	29.5	27.7	43.7	40.3
GZG 239	2	36.0	33.9	41.1	38.0
Hinova YR	3	28.4	27.3	28.1	25.2
HMX 0221	4	31.4	27.9	33.1	29.8
HMX 0222	5	33.4	33.2	41.9	40.7
HMX 0224	6	32.1	24.1	31.7	29.9
Mentor YR	7	36.2	32.4	33.2	32.1
Moreton Hybrid	8	38.4	38.0	43.1	43.1
Oriental Super Cross	9	43.9	34.6	47.9	46.5
Score	10	43.4	42.3	44.8	44.7
Strukton	11	29.8	27.0	28.8	24.1
Transam YR	12	35.3	34.2	36.2	33.6
Missouri	13	35.6	32.7	23.3	13.0
Huron	14	33.9	32.0	28.5	21.6
CV		15.90	18.60	14.90	18.30
Pr > F		***	***	***	***
DMRT (0.05)		9.45	10.28	9.20	10.39

*** denote significance at alpha = 0.01.

Table 12. Head and core traits of fourteen genotypes of kraut-type cabbage planted on May 10, 2001 at the OSU Vegetable Crops Research Branch in Fremont, OH.

Entry		Head					Core		
		weight (g)	density (g/cm ³)	diameter		height/ width ratio	length (cm)	base width (cm)	percent of head volume
Name	#			polar (cm)	equatorial (cm)				
Almanac	1	2477.5	0.831	17.8	17.8	1.00	7.0	3.3	0.69
GZG 239	2	2442.5	0.823	17.9	17.8	1.01	5.5	3.9	0.72
Hinova YR	3	2338.0	0.903	17.3	16.8	1.04	7.2	3.0	0.68
HMX 0221	4	2382.5	0.936	16.6	17.2	0.97	6.3	3.7	0.91
HMX 0222	5	2297.5	0.918	16.2	17.4	0.93	4.6	3.9	0.73
HMX 0224	6	2410.0	0.918	17.2	17.0	1.01	5.2	3.8	0.75
Mentor YR	7	2442.5	0.873	16.6	18.3	0.91	7.1	3.3	0.73
Moreton Hybrid	8	2782.5	0.912	17.4	18.6	0.94	7.5	3.3	0.69
Oriental Super Cross	9	3127.5	0.760	14.4	25.2	0.59	7.5	3.2	0.51
Score	10	2827.5	0.871	18.0	18.7	0.97	6.8	3.7	0.76
Strukton	11	2267.5	0.856	17.7	16.6	1.01	7.9	3.6	1.04
Transam YR	12	2717.5	0.919	17.8	17.9	1.00	7.1	3.9	0.93
Missouri	13	3317.5	1.275	17.4	17.2	1.02	7.7	3.8	1.07
Huron	14	2467.5	0.887	17.5	17.4	1.01	7.9	3.6	0.97
<hr/>									
CV		20.65	20.8869	5.14	5.96	3.832	9.02	5.43	13.109
Pr > F		NS	NS	***	***	***	***	***	***
DMRT _(0.05)		914.20	0.3231	1.50	1.85	0.628	1.05	0.33	0.179

NS = not significant, *** denotes significance at alpha = 0.01.

Table 13. Head and core traits for fourteen genotypes of kraut-type cabbage planted on June 20, 2001 at the OSU Vegetable Crops Research Branch in Fremont, OH.

Entry		Head					Core		
		weight (g)	density (g/cm ³)	diameter		height/ width ratio	length (cm)	base width (cm)	percent of head volume
Name	#			polar (cm)	equatorial (cm)				
Almanac	1	3177.5	0.851	18.4	20.1	0.92	8.1	3.1	0.53
GZG 239	2	2965.0	0.826	18.6	19.4	0.96	7.5	3.6	0.69
Hinova YR	3	2515.0	0.915	16.8	17.9	0.94	7.4	2.8	0.57
HMX 0221	4	2665.0	0.872	17.7	18.3	0.97	7.0	3.7	0.82
HMX 0222	5	2872.5	0.921	17.4	18.8	0.93	6.6	3.6	0.70
HMX 0224	6	2545.0	1.378	16.5	17.3	0.95	6.7	3.4	1.05
Mentor YR	7	2820.0	0.933	17.2	18.8	0.92	7.8	3.1	0.64
Moreton Hybrid	8	3001.5	0.783	18.9	19.8	0.96	9.0	3.0	0.56
Oriental Super Cross	9	3447.5	0.813	15.7	24.3	0.65	7.1	3.3	0.49
Score	10	3152.5	0.873	18.4	19.5	0.95	7.6	3.4	0.63
Strukton	11	2247.5	0.971	16.5	16.3	1.02	8.4	3.9	1.41
Transam YR	12	2410.0	0.975	16.3	17.3	0.84	7.6	4.0	1.31
Missouri	13	2042.5	0.974	16.2	15.5	1.05	7.7	4.2	1.71
Huron	14	2200.0	0.966	16.3	16.4	1.00	7.3	3.7	1.15
<hr/>									
CV		11.18	26.9954	3.91	4.78	3.303	8.29	3.75	22.059
Pr > F		***	NS	***	***	***	***	***	***
DMRT _(0.05)		519.10	0.4298	1.15	1.52	0.053	1.07	0.22	0.330

NS = not significant, *** denotes significance at alpha = 0.01.

Table 14. Influence of planting date on yield and head traits of fourteen genotypes of kraut-type cabbage planted on May 10 and June 20, 2001 at the OSU Vegetable Crops Research Branch in Fremont, OH. An asterisk (*) indicates that planting date had a significant effect on the variables listed within the genotype according to the Fisher Least Significant Difference test (alpha = 0.05). Analysis based on the mean of four replicates per planting.

Entry		yield (ton/A)		head				core			# of 9 traits effected by planting date
Name	#	total	marketable	weight (kg)	density (g/cm ³)	diameter (cm.) polar	diameter (cm.) equatorial	length (cm.)	base width (cm.)	% of head volume	
Almanac	1	*	*	*			*	*		*	6
GZG 239	2			*			*	*			3
Hinova YR	3						*				1
HMX 0221	4				*						1
HMX 0222	5	*	*	*		*		*	*		6
HMX 0224	6							*	*		2
Mentor YR	7			*					*		2
Moreton Hybrid	8				*	*		*	*	*	5
Oriental Super Cross	9		*	*							2
Score	10								*	*	2
Strukton	11				*					*	2
Transam YR	12					*				*	2
Missouri	13	*	*			*	*			*	5
Huron	14		*								1
number comparisons of 14 significant		3	5	5	3	4	4	5	5	6	

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